Ground Based Low Redshift Supernova Sample

C. Baltay, S. Perlmutter

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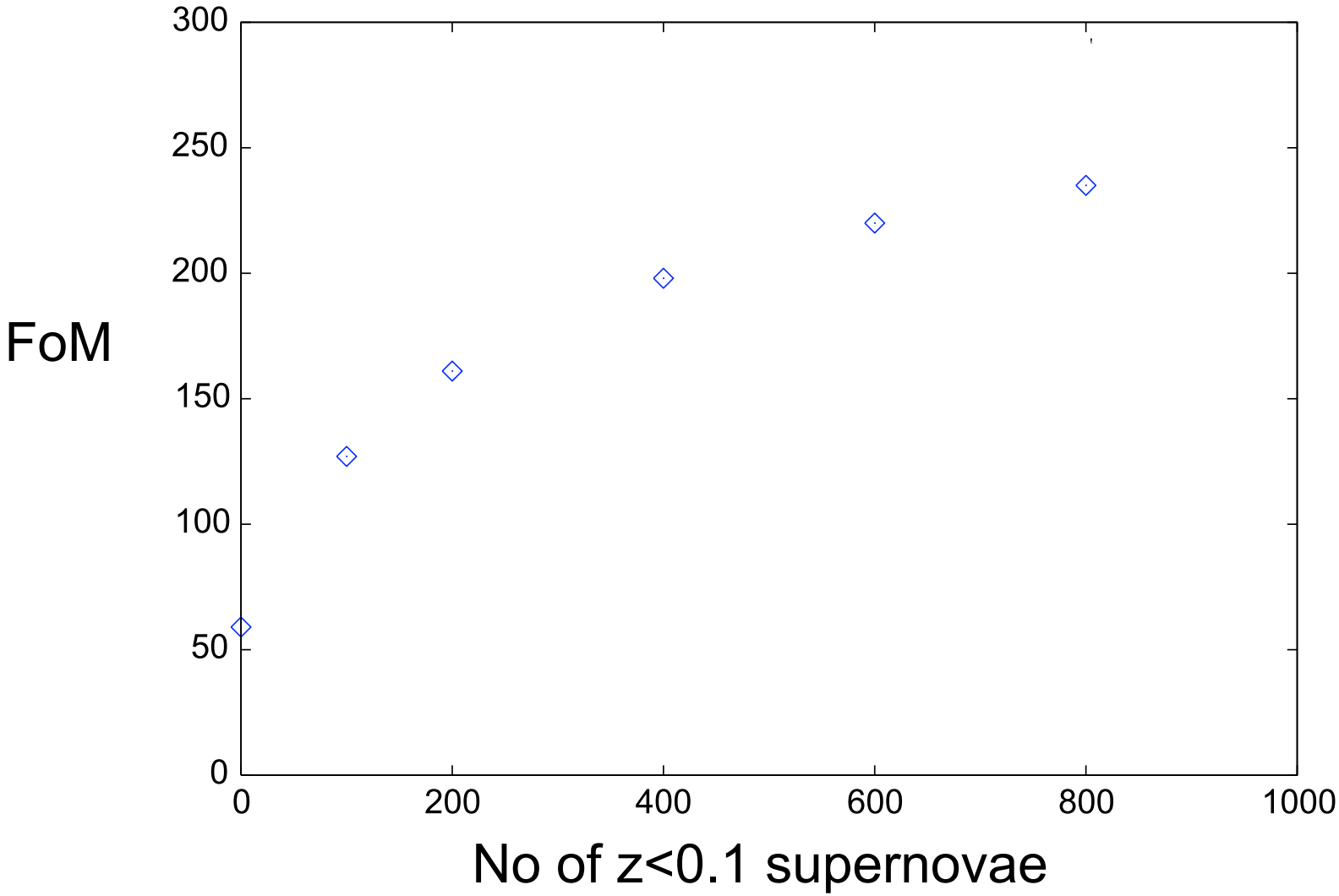
Need Ground based Low Redshift Sample

- High redshift Supernovs very faint, light redshifted into the infrared
  - Need Space, survey10's of sq degrees for 6 months
- Low redshift (z< 0.1) supernova very rare (volume effect) but bright, light is in the optical
  - Better done from the ground with 1 to 2 m telescopes, ~10,000 sq degrees over many years

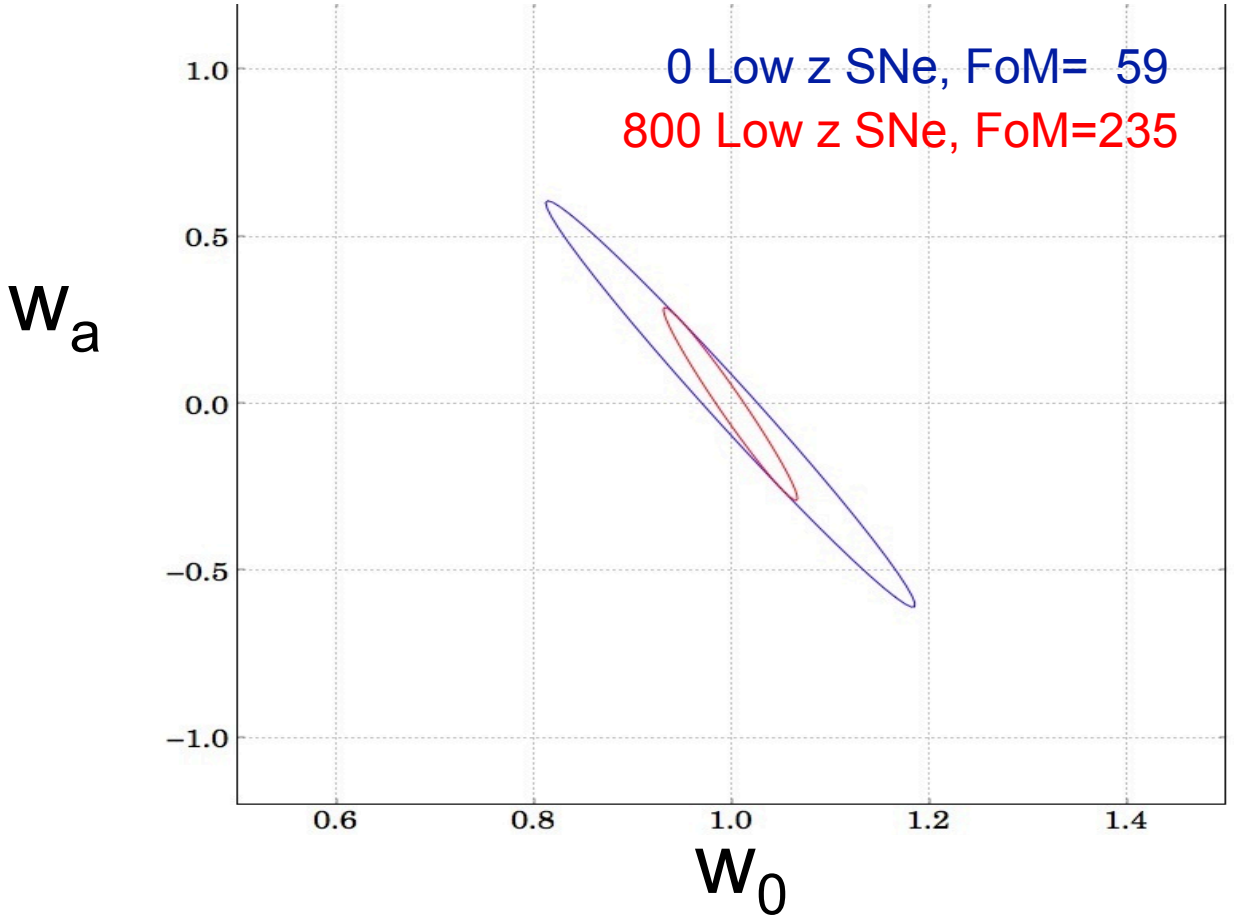
WFIRST Figure of Merit vs no. of low z SNe

800 to 1000 supernovae are important



WFIRST Error ellipses in w_a-w_0

Supernova only, without Stage III Priors



Low Redshift Supernova Surveys

Survey	Feature	Published	Expected
Collected Present Total Sample	photometric	128	
SNfactory	spectrophotometric		300
CSP-II	near infrared		100
PTF	photometric		300
LaSilla/QUEST	photometric		300
SkyMapper	photometric		200?

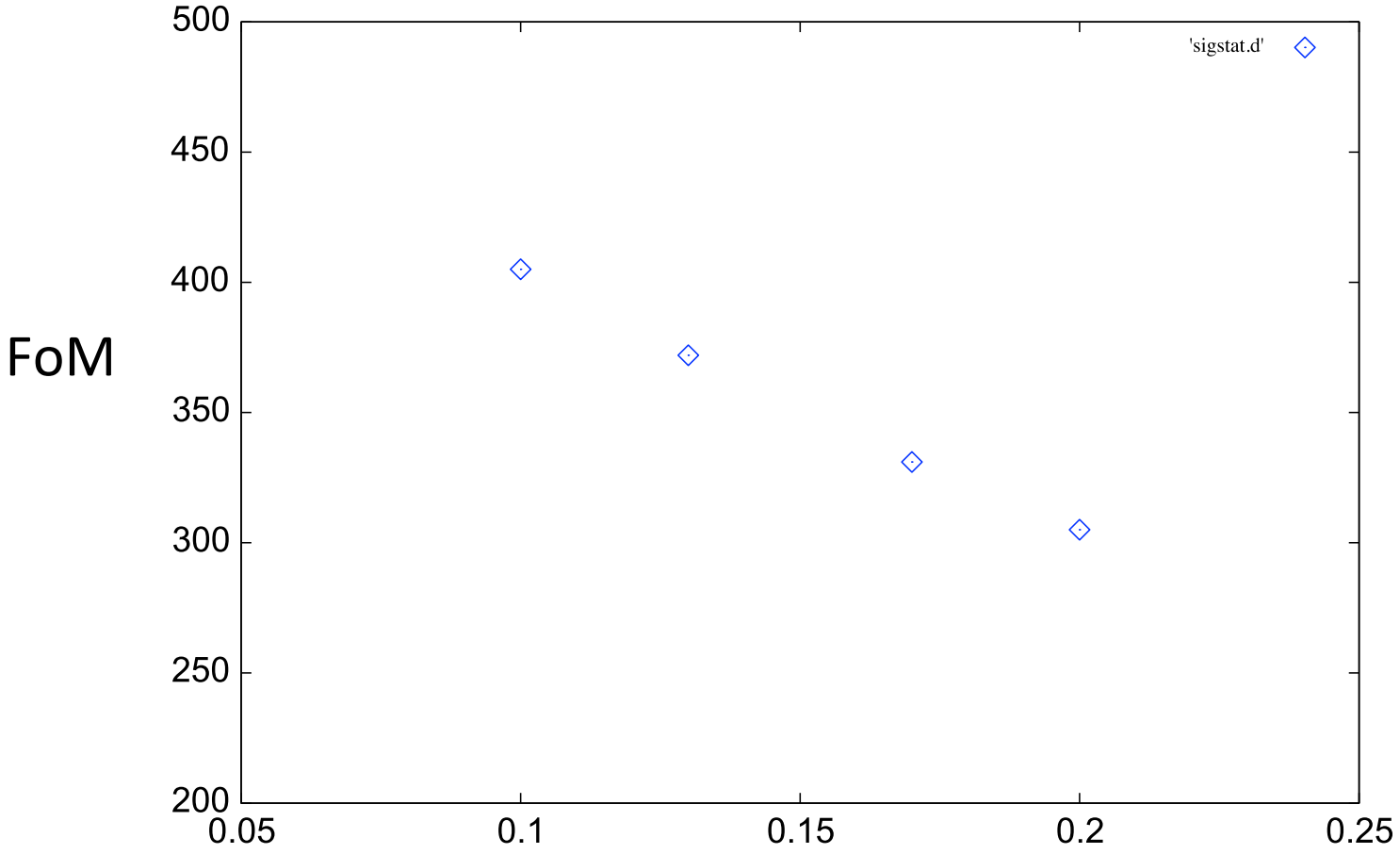
Size of Ground Based Low-z sample Probably OK

- WFIRST benefits greatly by 800 or more ground-based low-z supernovae
- Surveys in progress promise ~1300 low-z SNe in the next two or three years
- Promises don't always show up on Hubble diagrams, but can continue surveys longer if necessary

- BUT *quality* of sample is important!!

  And even more so for the control of systematics such as SN population drift.

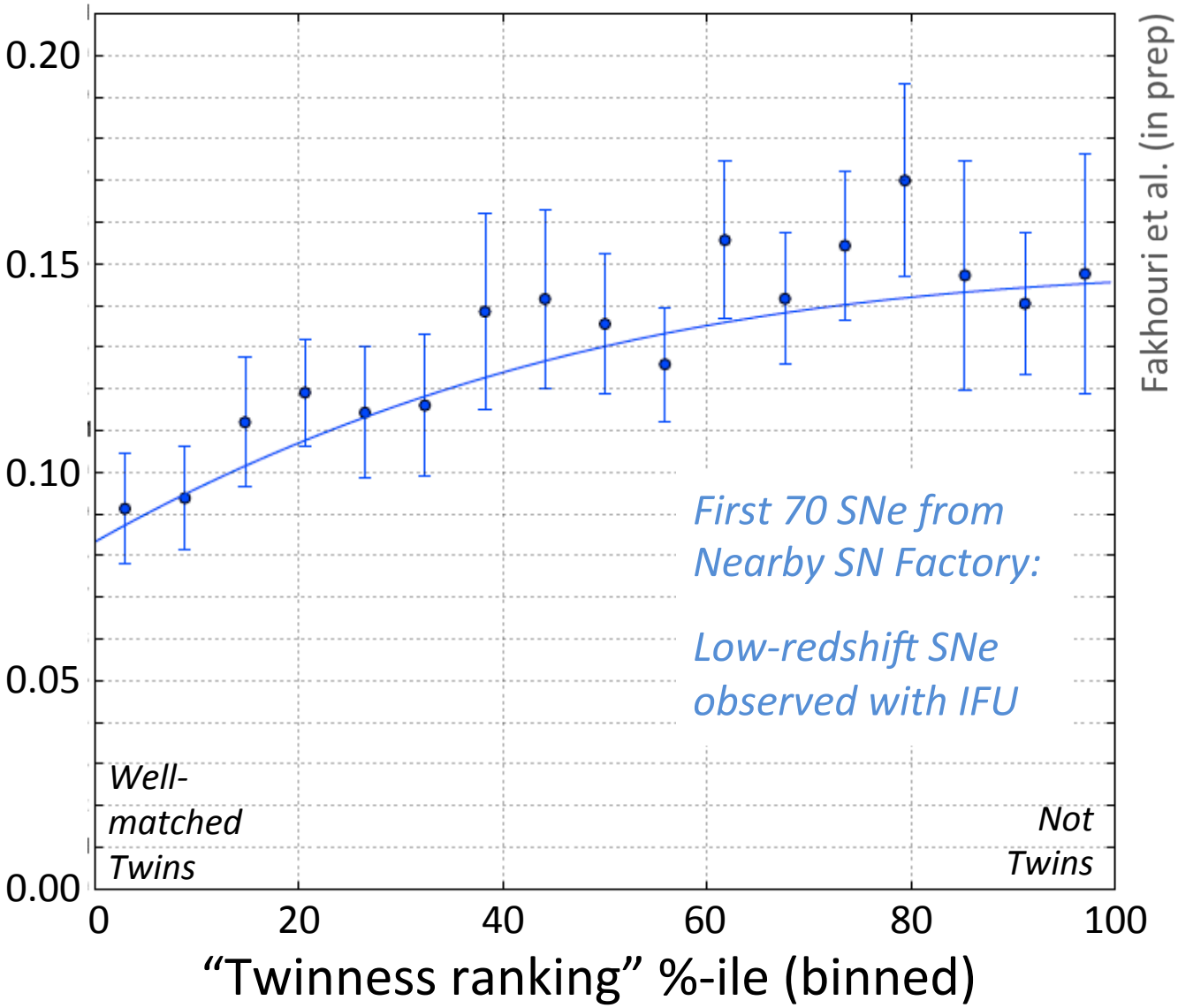
FoM Dependence on Statistical Spread of the Low-z Sample



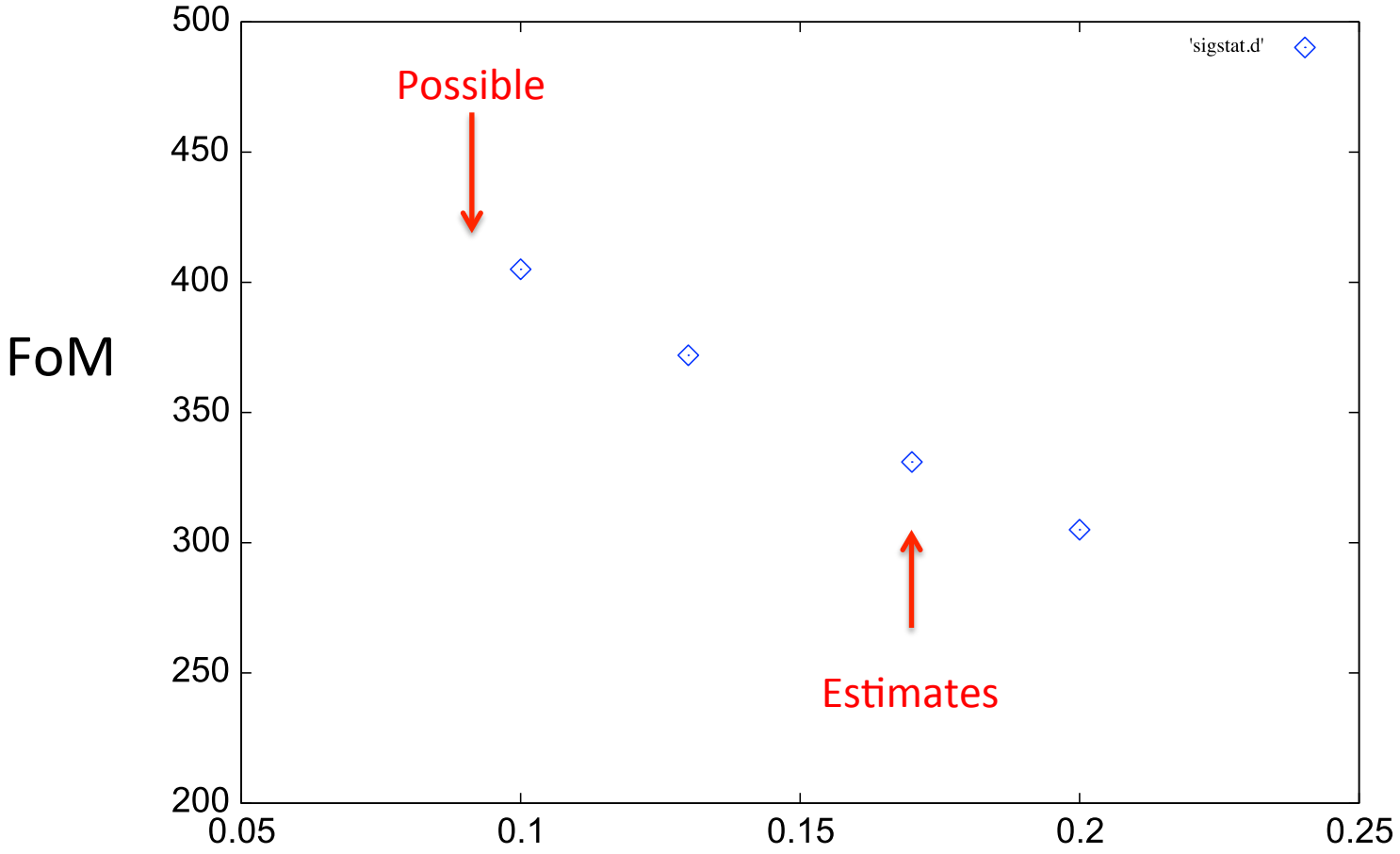
Quality of Samples

- In our previous generations of WFIRST estimates we assumed 800 low z ($z < 0.1$) supernova with a 17% spread in magnitudes and a 1% relative calibration to the WFIRST high z sample
- 17% spread is usual for samples with photometric light curves.
- Matching SNe using spectrophotometric light curves, as from the SNfactory, now achieving a 9% spread (see next slide), better then we assumed in our previous calculations.
- These matching techniques, applied across redshifts (and between ground- and space-based samples), using spectrophotometry with IFU's, makes it possible to constrain the SN population-drift systematic uncertainties.
- Should continue increasing the spectrophotometric ground based sample (a 20% increase in the FoM possible)

Much lower dispersion for spectrophotometrically matched SNe



FoM Dependence on Statistical Spread of the Low-z Sample



Conclusion

- We are well on our way to a sufficiently large sample of ground-based low-redshift supernovae with the quality we assumed in our WFIRST calculations, however…
- …WFIRST would further benefit significantly from a larger spectrophotometric low-redshift sample, to allow matching the low and high-redshift samples and use the much smaller dispersion of matched samples.

  Projects to continue to collect larger spectrophotometric low-z samples are now being developed
- Matching techniques between ground and space based samples, using spectrophotometry with IFU's, also makes it possible to constrain systematic uncertainties, SN population drifts in particular.
- Good calibration is also crucial !!